

## Problem Set 4

Introduction to Environmental and Resource Economics, November 21, 2003

Due Dec. 2

1. Explain in words why we compare costs and benefits in present value terms (why we “discount”), as opposed to simply summing up costs and benefits across time periods. What impact does discounting have on preferences for benefits now as opposed to in the future? What does this imply for sustainable resource use? (briefly)
2. Assume that you have won the lottery, and you have a choice of receiving \$4000 today or \$4200 one year from now. If the interest rate were 10%, which would you prefer? Does the value of the discount rate affect your choice? Explain.
3. Calculate the present discounted value of a one-time payment of \$350 in seven years at the following discount rates: 6%, 8% and 10%. In each case, what is the most you would be willing to pay now to receive this payment in 7 years?
4. Imagine that you are a member of the Fairfax city council, and the council is trying to choose between two plans for the new Old Town “lifestyle center”. The first plan (A) would allow for very fast completion of the project, but the infrastructure is projected to depreciate rather quickly. The second plan would be implemented gradually. Because of uncertainty about the retail situation in the future, the council decides to do a four-year cost benefit analysis in order to choose between the two projects. The estimated stream of net benefits for each project is given by:

	Year 1	Year 2	Year 3	Year 4
Plan A:	60	20	20	10
Plan B:	30	30	30	30

- (a) The city first decides to use its relatively low Fairfax City Bond rate as the interest rate for discounting purposes. The current rate is 5%. At this interest rate, which project is preferred?
- (b) One member of the council expresses concerns that the rising US government deficit will lead to much higher interest rates in the near future. She suggests comparing projects at a higher interest rate, 15%. At this rate, which project is preferred?
- (c) Can you explain intuitively why you got the results that you did with each interest rate?

5. Assume that the City of Fairfax is also considering a plan to build a new community center. The potential marginal social benefits of the project in square feet (in present discounted value terms) are given by:

$$MSB = 10000 - \frac{1}{2}Q$$

and the marginal construction and maintenance costs are given by:

$$MSC = 1000 + Q$$

resulting in a marginal net benefit function of:

$$MNB = 9000 - \frac{3}{2}Q$$

Unfortunately, the city council doesn't know (and can't directly estimate) these marginal benefit and cost curves. They have, however, hired a consultant to estimate total benefits and costs. The consultant has estimated that for any level of  $Q$ , the total benefits of the center are given by:

$$TB = 10000Q - \frac{1}{4}Q^2$$

and the total costs are given by:

$$TC = 1000Q + \frac{1}{2}Q^2$$

implying that total net benefits are:

$$TNB = 9000Q - \frac{3}{4}Q^2$$

They have space available to build a 10,000 square foot community center, and they have once again decided cost-benefit analysis to make the decision. Please help them make their decision by answering the following questions:

- What are the estimated *total* benefits of the proposed center?
- What are the estimated *total* costs of the proposed center?
- Are the net benefits (total benefits - total costs) of the project positive? Should the city build the project?
- What would the socially optimal size of the center be? Is the proposed center larger or smaller? Explain why the proposed center does not generate as high a level of benefits as the optimally sized center. (Hint: Plot the marginal net benefit function. What is happening with this function at the value of the proposed project?)